Region of Durham utilizes Algonquin Modular Panel Temporary Bridge System to reconnect community of Beaverton, Ontario

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Paper prepared for the session Transportation Structures
2026 Transportation Association of Canada (TAC) Conference & Exhibition
Winnipeg, Manitoba

Acknowledgements

The author gratefully acknowledges the Ministry of Transportation Ontario (MTO) as the Grantor for providing the funding and support that enabled delivery of the Beaver River Temporary Bridge project, as well as Algonquin Bridge for their collaborative support during the design and supply of the modular bridge system, and Elirpa Construction and Materials Ltd. for their effective execution of the construction works under emergency conditions

Abstract

In November 2022, the Beaver River Bridge on Regional Road 15 in the community of Beaverton was closed following inspections that identified advanced deterioration of the concrete structure and concerns regarding its ability to safely carry traffic loads. To restore connectivity while advancing the permanent bridge replacement, the Region of Durham implemented an accelerated program to design and construct a temporary crossing.

Following evaluation of several alternatives, a single-span modular panel bridge was selected due to its rapid deployment, constructability, and compatibility with the future permanent bridge works. A key aspect of the project was the integrated development of the temporary and permanent bridge solutions. The temporary bridge alignment and foundation layout were designed to accommodate staged construction of the permanent replacement structure while maintaining traffic, minimizing potential rework and improving overall project efficiency.

Through close collaboration between the Region, Algonquin Bridge, and the Contractor, engineering, permitting, utility coordination, procurement, and construction activities were advanced concurrently to support the accelerated schedule. The resulting two-lane CL-625-ONT rated temporary bridge was successfully delivered within six months of project authorization and remains in service while construction of the permanent replacement bridge proceeds.

This paper describes the planning, design, and construction of the temporary bridge and highlights the benefits of modular bridge technology, collaborative project delivery, and early integration of temporary and permanent works. The project provides insight for municipalities responding to unexpected infrastructure closures while advancing long-term infrastructure renewal objectives.

Figure 1. Beaver River Temporary Bridge – South Elevation

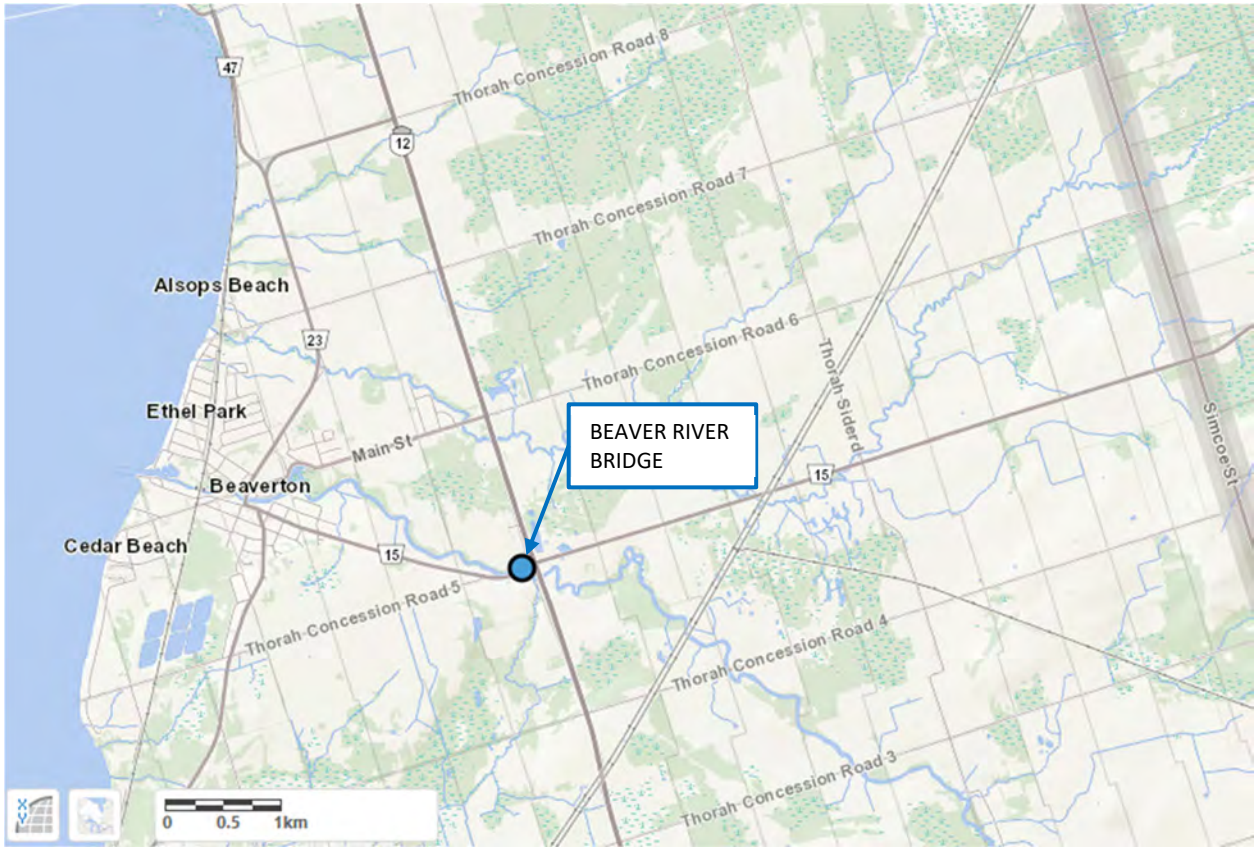


Source: Region of Durham

Introduction

The existing Beaver River Bridge on Regional Road 15 in the community of Beaverton was closed in November 2022 following inspections that identified advanced deterioration of the concrete structure and associated concerns regarding the bridge's ability to safely carry traffic loads. Having served the community for nearly 60 years, the bridge was a key transportation link between Downtown Beaverton and Highway 12, carrying Regional Road 15 over Beaver River immediately west of Highway 12 as shown in Figure 2. Its closure resulted in a significant detour for local residents, businesses, and emergency vehicles. In response, the Region of Durham initiated an accelerated program to restore traffic while advancing plans for permanent bridge replacement.

Figure 2. Beaver River Temporary Bridge Location



Source: Ontario Ministry of Natural Resources

Following evaluation of several alternatives, a temporary modular panel bridge was identified as the preferred solution due to its rapid deployment, constructability, and ability to maintain traffic during construction of the permanent replacement bridge. The project presented several challenges, including environmental and regulatory requirements associated with the Beaver River, utility conflicts, proximity to the Highway 12 intersection, and a compressed schedule from planning through construction.

While restoring traffic was the immediate priority, the project team recognized the importance of developing a solution that also supported the long-term bridge replacement strategy. As a result, the temporary bridge design was advanced in parallel with preliminary road and bridge design for the permanent replacement structure. This integrated approach allowed the temporary bridge alignment and foundation layout to be developed with future staging requirements in mind, accommodating construction of the permanent bridge while maintaining traffic and minimizing the potential for rework.

This paper outlines the planning, design, and construction of the Beaver River Temporary Bridge, highlighting the engineering, environmental, regulatory, construction considerations that contributed to the successful delivery of a two-lane CL-625-ONT rated crossing within six months of project authorization. Achievement of this accelerated timeline required bridge design, procurement, permitting, utility coordination, and construction planning to proceed concurrently rather than consecutively. Particular emphasis is placed on the integration of temporary and permanent works and the collaborative approach between the Region, Algonquin Bridge, and the Contractor, demonstrating

how municipalities can respond effectively to unexpected infrastructure closures while advancing long-term infrastructure renewal and asset management objectives.

Site and Existing Infrastructure Background

The Beaver River bridge was constructed in 1965 by MTO as part of the Highway 12 and Regional Road 15 intersection improvements in Beaverton. Following establishment of the Regional Municipality of Durham in 1974, the bridge was managed as part of the Region's bridge inventory and inspected in accordance with the Ontario Structure Inspection Manual (O. Reg. 472/10). Due to the level of visible deterioration evident on this bridge, structural inspections have been carried out annually since 2016 by consultants with the most recent being July 2023.

Due to increasing visible deterioration, annual inspections were undertaken beginning in 2016. To better define the condition of the structure and support rehabilitation planning, additional investigations were completed, including a Detailed Condition Survey, structural evaluation, and a post-tensioning investigation. Based on the findings of this work, a triple-posting weight restriction of 9/10/13 tonnes was implemented in March 2020.

Recognizing the operational impacts associated with such restrictions, particularly on winter maintenance operations, the Region completed accelerated strengthening works in December 2020 consisting of a structural concrete deck overlay. Upon completion of this work, the bridge was reopened to traffic with the weight restrictions removed.

Following completion of the repair work, the Region advanced preliminary design for a permanent replacement structure, with funding anticipated for 2024 and construction planned for 2025. As part of this work, Region and MTO staff met in March 2023 to discuss potential improvements at the Regional Road 15 and Highway 12 intersection that could affect the future bridge geometry and roadway design.

During replacement planning, a review of property ownership determined that the bridge was located within MTO-controlled lands. Although the bridge had historically been managed as a Regional asset, ownership was formally confirmed as belonging to MTO in August 2023. Shortly thereafter, concerns identified during a October 2023 bridge inspection prompted additional evaluation and load testing by MTO.

The bridge was temporarily closed in November 2023 pending the results of the load test. Testing completed in December 2023 confirmed a substantial reduction in structural capacity and identified the need for a triple-posting restriction of 7/13/18 tonnes. Given the impracticality of enforcing such low weight limits, the bridge remained closed.

The closure had immediate impacts on local residents, businesses, emergency services, and regional transportation operations. Concurrently, discussions were required between the Region and MTO to establish project governance and determine responsibility for delivering a replacement solution. MTO ultimately approved funding for both temporary and permanent bridge replacements on May 17, 2024. Regional Council subsequently declared the closure an emergency on May 29, 2024, and authorized staff to proceed with implementation of the temporary bridge and permanent replacement projects.

To expedite delivery, Region staff completed the design of the temporary bridge foundations, roadway works, and associated infrastructure, while Algonquin Bridge (Algonquin) designed and supplied the modular bridge system. The property transfer from MTO to the Region was completed on July 16, 2024, allowing demolition and construction activities to proceed. The accelerated delivery approach and collaboration between the Region and Algonquin, enabled the temporary bridge to be completed and opened to traffic on November 14, 2024.

Site Conditions and Existing Infrastructure

Roadway Characteristics at the Crossing

Regional Road 15 is an east-west road located in the Township of Brock and is designated as a Type 'B' arterial road in the Durham Regional Official Plan (ROP). Type 'B' arterial roads are intended to provide uninterrupted traffic flow at speeds of 60 km/h in urban areas, and 80 km/h outside of urban areas, while complimenting adjacent land uses and acting as connector roads to freeways, other arterial roads, and collectors, as part of an integrated network.

Existing Bridge Description

The existing structure, which was constructed in 1965 and closed to traffic in 2023, carried one lane of traffic in each direction. The superstructure consisted of a 381 mm thick post-tensioned concrete slab. The structure had three spans of 11.58 m, 13.72 m, and 11.58 m, with a total length of 36.88 m between abutment bearings. The structure was skewed at 25˚ and varied in width from 12.19 m at the west to 15.21 m at the east to accommodate a right turn lane at the intersection. The bridge had 914 mm wide curbs on either side with open steel railings.

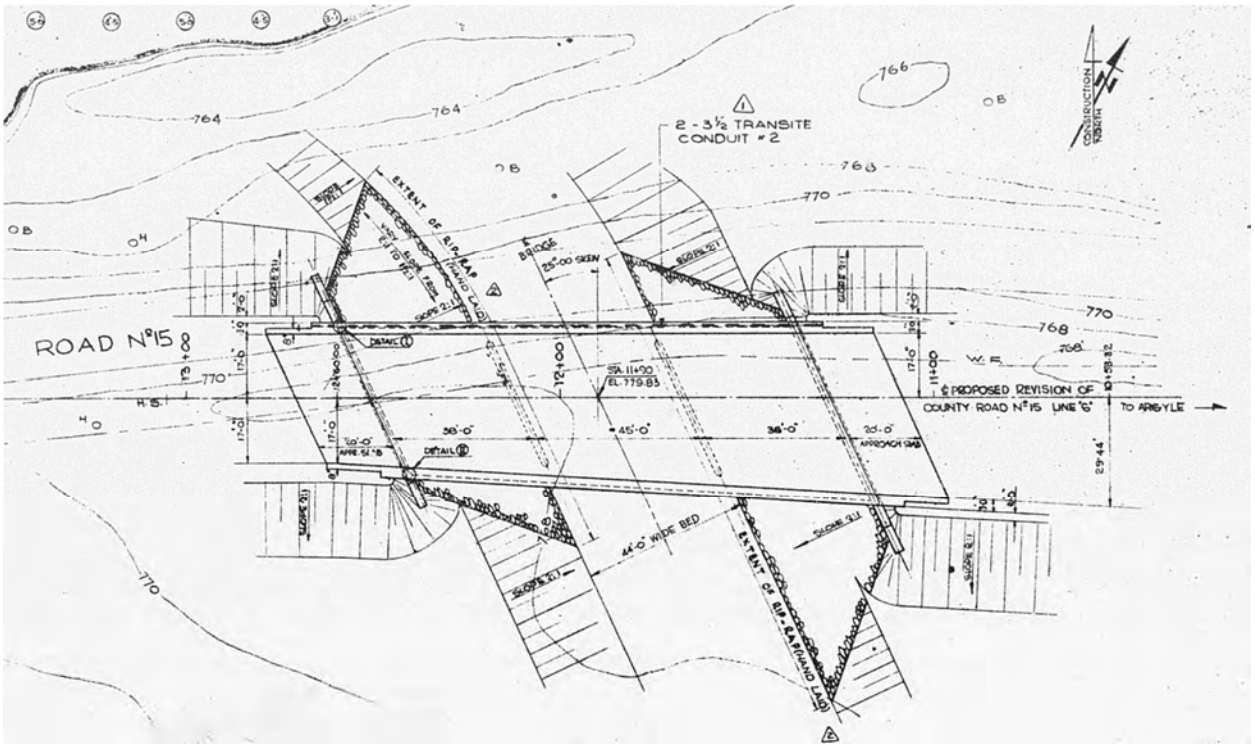
The existing bridge was supported on reinforced concrete abutments and piers with driven tube piles. The existing foundations and piers were skewed to follow the alignment of the river. The existing piers were located within the water, at the edge of the river under normal water level conditions.

Figure 3. Original Beaver River Bridge – South Elevation



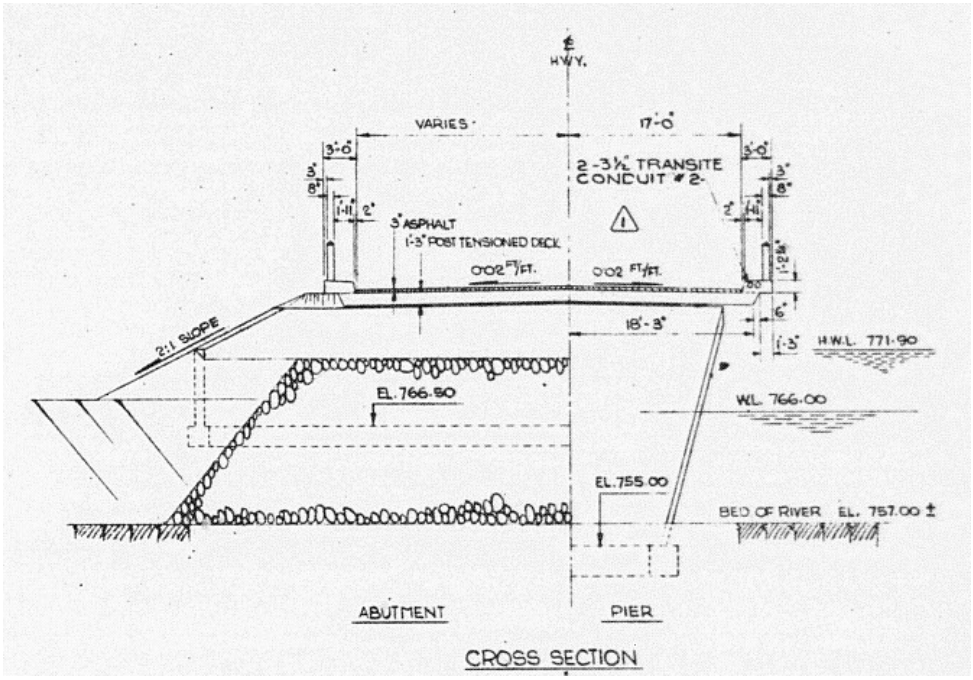
Source: Region of Durham

Figure 4. Original Beaver River Bridge – Plan



Source: Region of Durham

Figure 5. Original Beaver River Bridge – Cross Section



Source: Region of Durham

River Characteristics

Beaver River is a moderate size warmwater river that flows in a northwest direction at the Regional Road 15 Beaver River Bridge crossing. The river outlets to Lake Simcoe, approximately 4 km downstream of the bridge. The existing three-span Beaver River Bridge had piers in the river, obstructing the river passage for marine life and therefore is unpreferable from a fisheries perspective.[1]

The original contract drawings note the High-Water Level (HWL) at 235.3 m. The minimum existing soffit elevation noted on the original contract drawings is 237.98 m, corresponding to 2.68 m of freeboard. However, as the bridge was constructed in 1965, this hydraulic data is over 50 years old and would require updating for design of the temporary bridge and permanent bridges as discussed in later sections of this report.

Site Constraints

The temporary bridge required a shifted alignment to accommodate staging and construction of the permanent bridge, which significantly limited the available placement options within the project limits. The alignment was further constrained by the proximity of the Highway 12 intersection, requiring coordination with the MTO to ensure impacts to the intersection were appropriately considered during planning and construction.

Additional constraints included overhead Hydro lines and underground Bell communications infrastructure within the project limits. A Subsurface Utility Engineering (SUE) investigation was undertaken to confirm utility locations and support development of a feasible bridge alignment. The findings identified the need to relocate Hydro infrastructure to accommodate demolition of the existing

bridge and construction of the temporary crossing. The underground Bell duct was daylighted to verify its location and inform foundation placement, allowing the temporary bridge to be constructed without impacting the existing utility infrastructure.

Environmental and Regulatory Constraints

The Beaver River crossing is located within a regulated watercourse, requiring consideration of fisheries, navigation, and floodplain requirements throughout project development. The project required coordination with several regulatory agencies, including the Lake Simcoe Region Conservation Authority (LSRCA), Fisheries and Oceans Canada, and Transport Canada.

Environmental investigations completed during the preliminary design phase for the permanent structure included ecological field surveys undertaken in 2022 and 2023, supported by ongoing consultation with the LSRCA and other regulatory agencies. These studies identified environmental constraints and informed the design, approval strategy, and construction approach for both the temporary bridge and the permanent replacement structure.

To support the expedited project delivery for the temporary crossing, the Region retained an environmental consultant to assist with agency coordination, permitting, environmental compliance, and construction monitoring. Early engagement with regulatory agencies helped facilitate approvals while ensuring environmental requirements were incorporated into the accelerated project schedule.

Design Criteria and Temporary Bridge Requirements

Design Code

The design of the temporary bridge was carried out in accordance with the latest version of the CHBDC (CAN/CSA S6-19) as well as the MTO Structural Manual. The bridge was designed to support CL-625-ONT loading.

The design life for the temporary bridge is two years, to accommodate design and construction of the permanent structure at this location.

Hydraulics

Design Flow

The temporary bridge was designed to satisfy the MTO Highway Drainage Design Standards (HDDS) (March 2024), as well as the LSRCA Technical Guidelines for Stormwater Management Submissions. In accordance with the requirements of the MTO HDDS WC-1, a structure on a rural arterial with a span greater than 6.0 metres should be designed to convey a minimum of the 50-year design flow. WC 1 also indicates increasing the design flow to the Regulatory event for vital routes which must remain useable during Regulatory Flow conditions, however, use of the Regulatory event in such cases shall be justified by a cost-benefit analysis.[2]

Changes in Upstream Water Levels

The MTO HDDS does not specify a single numerical maximum allowable increase in flood elevations or water surface elevations (WSE) upstream of highway water crossings or related drainage works. Instead, the standards emphasize calculating existing vs. proposed upstream WSE for the Design Flow, Regulatory Flow (where applicable), Check Flow, and a range of flows to assess backwater effects and impacts. Any increase in flood elevation is evaluated for risks to public safety, adjacent properties, private lands, or natural areas/habitats in consultation with the Municipality, Conservation Authority, or the Ministry of Natural Resources and Forestry given their responsibilities under the Conservation Authorities Act and Lakes and Rivers Improvement Act.[2] The goal is effectively "no adverse impact" or "no increase in flood risk" and is determined case-by-case.

The LSRCA criteria require that if changes are proposed within the floodplain such as cut/fill balance or new watercourse crossing, it must be demonstrated that there are no negative impacts upstream or downstream in accordance with the Authority Ontario Regulation 179/06 Implementation Guidelines.[3]

Alternative Solutions Assessment

Maintaining the closure was not acceptable because of impacts to emergency response, local businesses, and regional traffic operations. The Township of Brock strongly advocated for an urgent solution to reopen the roadway, citing increased emergency response times and negative impacts on local businesses.

Preliminary discussions were held to identify potential means of maintaining connectivity during design and construction of the permanent bridge replacement. Several concepts were dismissed at an early stage because they would not adequately resolve the project's key constraints, leaving a modular Bailey-style bridge as the most viable option. A temporary culvert crossing was not feasible due to hydraulic, environmental, and permitting constraints associated with Beaver River. Conventional temporary bridge construction would have required significant design effort and material procurement, making delivery within the available schedule unlikely.

The modular panel bridge system was ultimately selected as it best addressed the project's key constraints while providing several implementation advantages, including:

- immediately available bridge components;
- ability to span the river without intermediate supports;
- proven performance under highway loading;
- rapid assembly and launching;
- compatibility with staged construction of the permanent bridge; and
- reduced environmental impacts through elimination of in-water works.

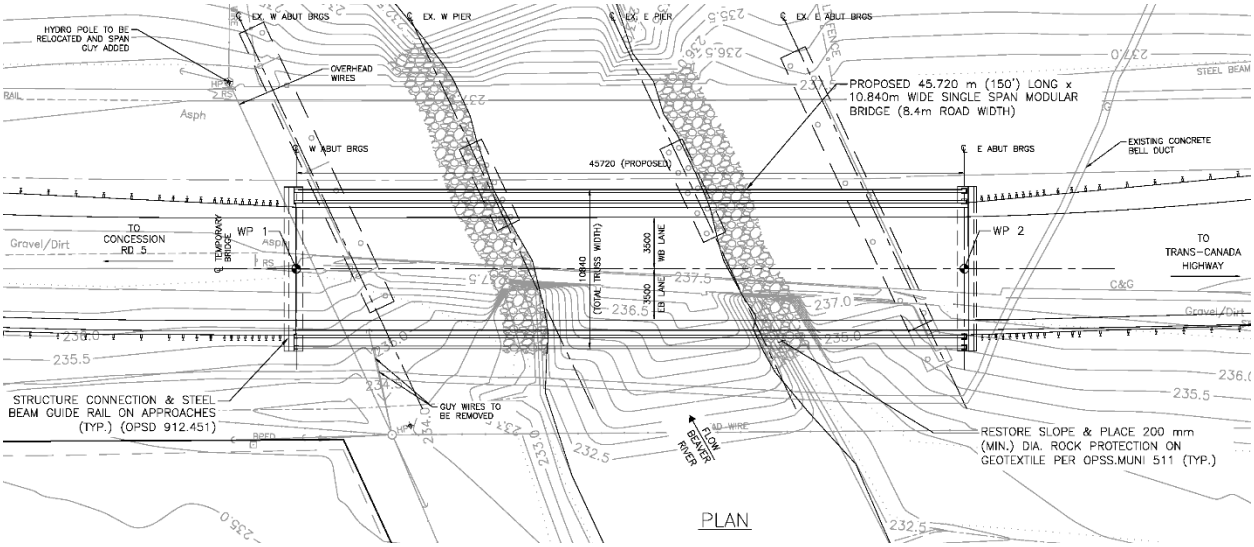
Temporary Bridge Solution

Region staff made exceptional efforts to efficiently deliver a temporary bridge design that would also support staging for the future permanent structure. The temporary bridge and roadway were shifted south to allow two lanes of traffic to remain open during the first stage of permanent bridge construction. Because of the proximity to the Highway 12 intersection, the design required extensive

coordination and approval from MTO. The plan and south elevation of the temporary bridge design are illustrated in Figure 6 and Figure 7, respectively.

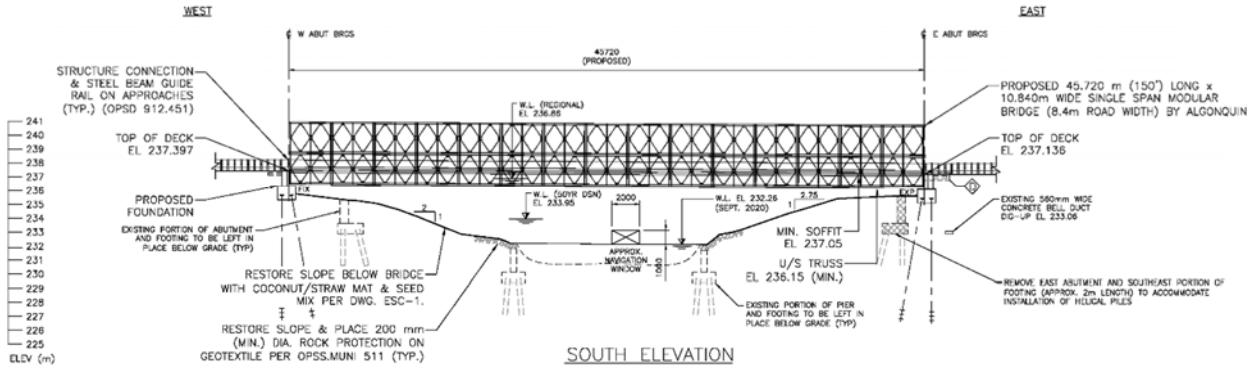
The many site constraints including the locations of the existing skewed pier and abutment foundations with driven piles, location of hydro utilities, and existing concrete bell duct crossing beneath the roadway at the east approach constrained the temporary bridge geometry. The Region selected a span of 45.72 m (150 feet) for the temporary bridge, with the abutments located behind the existing bridge abutment footings. The east abutment location was critical as there was extremely limited space in the southeast quadrant between the existing abutment footing and the buried bell duct. It was also necessary to closely review the existing and proposed pile geometry to avoid any conflicts.

Figure 6. Beaver River Temporary Bridge – Plan



Source: Region of Durham

Figure 7. Beaver River Temporary Bridge – South Elevation



Source: Region of Durham

The use of a single-span temporary bridge simplified both installation and removal while minimizing the amount of temporary materials required. The incorporation of intermediate piers would have required their subsequent removal to facilitate construction of the permanent bridge, resulting in additional material waste and more complex construction staging. The required service life of the temporary structure was addressed through detailing that provided appropriate robustness and durability. To

further enhance constructability and accommodate the accelerated project schedule, the Region encouraged Contractor input on material availability and construction methods throughout the design process.

Site constraints, including the close proximity of the Highway 12 intersection immediately east of the bridge, limited opportunities to significantly modify the roadway profile. Consequently, the deck elevations at both ends of the temporary bridge were maintained at approximately the same elevation as the existing structure.

The existing skewed abutment and pier configuration could not be utilized to support the temporary bridge. To avoid conflicts with existing foundations, including abutments, footings, and piles, the temporary bridge foundations were located behind the existing foundations. This approach also eliminated the need for in-water works and dewatering of excavations. As a result, a single-span temporary bridge was identified as the preferred solution, providing environmental benefits while simplifying construction and future removal.

The temporary bridge profile was designed to closely match the existing roadway elevations, minimizing the amount of approach fill required. The soffit elevation was also maintained at a similar elevation to the existing bridge to maintain the required hydraulic freeboard. In response to the accelerated project schedule, the Region adopted a construction-driven design approach and worked closely with Algonquin and the Contractor throughout the design process to confirm the feasibility and constructability of the proposed solution.

The above grade portions of the existing abutments and piers were removed with demolition of the existing structure. However, due to the limited time available for construction the temporary bridge and the desire to avoid installing sheet piling that could complicate future removal or interfere with staging works of the permanent bridge works, removal of the foundations below grade was minimized. It was recognized that some additional removals would be required during construction of the permanent bridge.

Road Design

To avoid another road closure during future construction, the Region proactively advanced preliminary design and approvals for the alignment of the permanent bridge and roadway at the same time as the temporary bridge design. This ensured that staging would be feasible and that the temporary alignment would integrate seamlessly with the long-term plan.

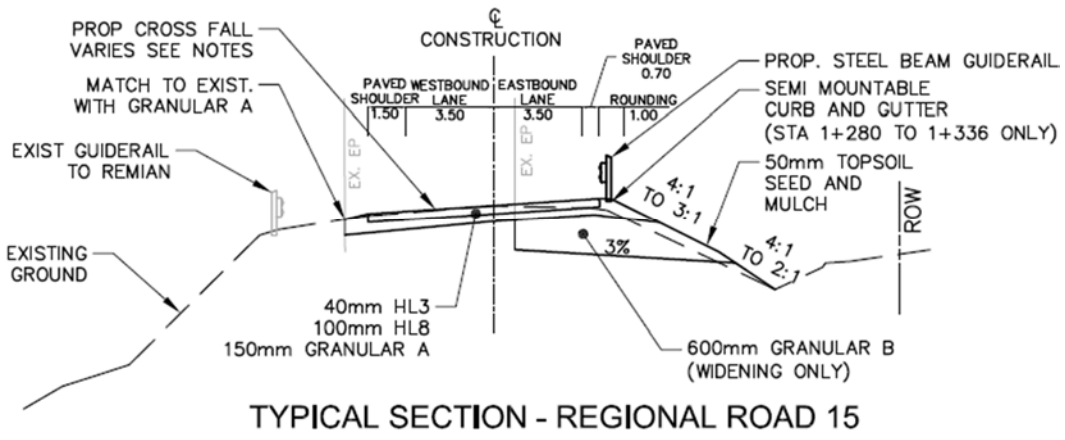
Through this coordination with MTO, the Region also optimized the footprint of the future bridge. The existing bridge included a taper to increase storage length for vehicles at the Highway 12 intersection, a feature no longer required under updated design criteria. Eliminating this taper from the bridge allowed for a more efficient permanent bridge layout.

The varying width of the existing structure proved to be significant in determining the road design for the temporary and permanent structures, as the bridge originally accommodated the taper for the right turn lane at the Highway 12 intersection. As the Region intended to incorporate the temporary bridge into the staging strategy for construction of the permanent bridge while maintaining two-lane traffic, efforts were focused on advancing the temporary and permanent road designs concurrently to improve overall project efficiency. Region staff consulted with MTO to confirm design criteria and obtain

approval for the Region's design calculations. It was determined that the right turn lane length could be reduced for the permanent design, eliminating the need for a tapered structure, and leading to a significantly improved design.

A typical section of Regional Road 15 under the temporary bridge conditions is shown in Figure 8. The temporary conditions, which will be in place until the second stage of construction of the permanent bridge, provide two 3.50 m lanes with 0.7 m paved shoulders. The vertical profile of the temporary bridge is on a tangent with a longitudinal slope of 0.5%.

Figure 8. Beaver River Temporary Bridge – Typical Section – Regional Road 15



Source: Region of Durham

Bridge Superstructure

Algonquin offers modular bridge systems for sale or rental that are derived from the original "Bailey Bridge" [4], a portable modular bridge system during the Second World War by British engineer Sir Donald Coleman Bailey. Constructed from standardized, interchangeable, high strength steel panels connected using pins, the Bailey Bridge enabled rapid assembly and could be configured to accommodate a wide range of span lengths and loading requirements. Its modularity, transportability, ease of installation, and adaptability led to widespread adoption during and after the war and continue to influence modern modular panel bridge systems used today.[4, 5]

Given the project schedule and the need for a temporary structure that could be installed and later removed, a modular panel bridge system was identified as the preferred superstructure solution. Algonquin recommended the R800 Modular Panel Bridge system, which utilizes 3 m long pinned panels and can accommodate clear spans of exceeding 82 m with roadway widths ranging from 3.15 m to 10.5 m. The system was well suited to the project due to its ability to span the Beaver River without intermediate supports, rapid installation characteristics, and immediate availability from Algonquin's Thornhill, Ontario inventory. These factors made the R800 a practical, fast, and cost-effective solution for maintaining traffic during construction of the permanent bridge.

Following selection of the modular bridge system, key design considerations included roadway width, shoulder width, and accommodation of pedestrians and cyclists. Algonquin's modular bridges can be configured with 1.5 m wide exterior walkways to provide separation between vehicles and pedestrians. However, pedestrian activity at the crossing is limited, and neither the existing bridge nor its approaches include sidewalks. Accommodating a cantilevered walkway would have increased the overall bridge

footprint, potentially creating additional utility conflicts and constructability challenges while either reducing the available roadway width or increasing foundation requirements. As a result, the walkway option was not pursued, and priority was given to maximizing the available deck width for vehicular traffic.

Based on these considerations, the temporary bridge was configured as a 45.72 m (150 ft) single-span modular panel bridge carrying two lanes of traffic and designed for CL-625-ONT loading by Algonquin. The selected truss configuration was DDHR2+++, with a standing height exceeding 6 m. The bridge provides an 8.4 m roadway width consisting of two 3.5 m traffic lanes and 0.7 m shoulders on each side. Fixed bearings were provided at the west abutment, while expansion bearings were provided at the east abutment to accommodate thermal movements. The bearings and base plates were designed and supplied by Algonquin.

Foundations

The modular structure is supported on helical piles with cast-in-place concrete pile caps. The pile layout and concrete pile caps were designed by the Region. Before selecting the foundation type, the Region reviewed several alternatives for the temporary bridge foundations in consultation with WSP. Prefabricated abutment types such as steel bin abutments or MSE retaining wall systems were initially considered due to the accelerated nature of the project, however it was determined that the poor soils at the site would not provide sufficient bearing resistance needed for these types of foundations. Spread footings were analyzed for their feasibility with respect to bearing resistances, with consideration for remediation by placing and compacting rock fill into the softer material to create a roughly 0.5 m to 1 m thick denser upper layer above the poor soils, or sub-excavation of softer material and replacement with a granular engineered fill pad. Three depths of sub excavation, up to 3 m below proposed founding level, were evaluated. Consideration was not given to full sub-excavation of the poor soils due to the extensive shoring and dewatering and/or cut-off requirements. Based on the analysis of these design alternatives, neither provided a factored ULS value that met the applied foundation loading.[6]

Based on the foundation analysis by WSP, it was determined that the only practical foundation alternative was to support the temporary bridge directly on a pile cap with helical piles, due to the poor soils at the site. WSP recommended the use of square helical piles with a 57 mm shaft size advanced into the native competent deposits at an approximate elevation of 228.3 m (approximately 8.6 mbgs). At this elevation the helical piles would be expected to provide the required ULS and SLS capacities, with confirmation by a helical pile load test recommended. If necessary, higher geotechnical resistances could be reached by advancing the piles deeper into the till or increasing the pile size. As vertical helical piles are not expected to provide resistance to lateral loads, installation of battered helical piles would be required to resist these loads.[6]

As a specialized contractor was required to design and install the helical piles, EBS Geostructural was retained by the Contractor. The temporary bridge foundations consist of a reinforced concrete pile cap at each abutment with two rows of Chance SS225 (6”-8”-10”) triple helix helical piles. The front row of piles is battered to resist lateral loads, and the back row is vertical. Rip rap was provided as scour protection for the foundations per the MTO HDDS and sized per the MTO Drainage manual.

Hydraulics

The Region completed a hydraulic analysis for the temporary bridge, based on HEC-RAS modelling. The flood elevations and flow velocity of the temporary bridge and existing bridge were compared to ensure the temporary bridge does not impact the flood elevations and flow velocities, and to recommend riprap protection under the bridge based on the design flow. The temporary bridge design has been assessed for the 50-year design flood and for the Regulatory Flood.

A cut and fill analysis was completed as a positive fill of approximately 630 m3 was required for temporary widening of Regional Road 15 to place the temporary bridge along the south edge of the site and accommodate staging of the permanent bridge construction. This fill is considered temporary to allow for placement of the temporary bridge and accommodate staging of the permanent bridge. As such, there is no area within the Region's right-of-way to provide any storage volume required to compensate for the loss of floodplain. Additional cuts within the Region's right-of-way will be reviewed and assessed for the proposed permanent bridge.

The hydraulic analysis of the temporary bridge confirmed that the temporary bridge does not impact flood elevations and flow velocities in a temporary condition.

Construction and Deployment

The project was awarded to Elirpa Construction and Material Ltd. (Elirpa) through the Region's Contractor Registry as emergency Time and Materials work. Algonquin Bridge was retained to design and supply the modular bridge components. Elirpa received approval to proceed on May 30, 2024, under an Emergency Declaration. The bridge opened to traffic on November 14, 2024, and Elirpa submitted the Statutory Declaration on February 7, 2025.

Because the road closure was declared an Emergency, every working day was critical. Upon authorization to proceed, the Region's design and construction Project Managers maintained daily communication with Elirpa and Algonquin to review design details, construction methods, and potential issues. This proactive coordination maximized efficiency and minimized risks related to constructability or supply. Algonquin provided on-site support throughout all project phases - pre-construction, active construction, and through to completion - to ensure a fast and efficient installation. Engineering support was also available on-call during working hours.

Elirpa submitted bi-weekly look-ahead schedules focused on upcoming two-week tasks, which helped coordinate material deliveries, inspections, and other time-sensitive activities. Region staff also issued bi-weekly Project Updates to stakeholders, outlining Recent Progress, the Two Weeks Ahead, and Looking Forward. This transparent approach reinforced accountability and helped prevent schedule slippage

Throughout construction, the Region conducted regular environmental inspections and implemented erosion and sediment control measures to minimize impacts

Bridge Demolition

The existing structure was removed using floating barges positioned beneath the bridge, providing a safe and efficient working platform with minimal environmental impact as shown in Figure 9. The load restriction and significant deterioration of the three-span post-tensioned deck created a risk of unexpected collapse during demolition. Figure 10 shows demolition of the existing bridge. The floating barges were able to the contain the extensive debris from removal of the concrete deck. Due to the extensive deterioration of the concrete deck and expected disintegration of the concrete during demolition works, the barges provided a platform to contain debris and prevent it from entering the watercourse

Temporary culverts or cofferdams were evaluated to protect the watercourse and provide worker access; however, due to the urgency of the work and the volume of water requiring diversion, these options introduced safety concerns related to flooding risks.

Figure 11 shows the Beaver River Bridge site after demolition of the existing structure, removal of the floating barges, and completion of a portion of the temporary roadworks to widen the road at the bridge approaches. The photo also shows two guy wires which were relocated, along with a hydro pole at the northwest quadrant, before construction of the west foundation and bridge assembly could take place.

Figure 9. Barge System for Demolition of Existing Beaver River Bridge



Source: Region of Durham

Figure 10. Demolition of Existing Beaver River Bridge



Source: Region of Durham

Figure 11. Beaver River Bridge Site Prepared for Construction of Temporary Bridge



Source: Algonquin Bridge

Bridge Launching

Launching of the bridge was determined early on to be the preferred installation method, due to site constraints such as overhead utilities and limited space within the closure. Launching was simplified as the bridge geometry, being a modular style bridge, follows a straight line in plan. The vertical girder profile is typically more forgiving than plan for launching. The foundations were designed for launching, with the backwall connected to the pile cap by dowels such that it would be constructed after the bridge was installed.

Assembly of the bridge was completed at the west approach within the closure. Once assembled and in place for launching, a crawler excavator with a force distribution beam was used to push the assembled superstructure, as shown in Figure 12. As the superstructure approached the center of the span, the cantilever moments increase and a mobile crane at the east approach assisted the launching operation by picking up the truss and guiding it to the east abutment, as shown in Figure 13. The girders landed on the east abutment rollers, and the mobile crane disconnected from the superstructure. The rollers were then removed, and the crane lowered the superstructure onto the bearings.

Figure 12. Launching of Beaver River Temporary Bridge



Source: Region of Durham

Figure 13. Crane Assist during Launching of Beaver River Temporary Bridge



Source: Algonquin Bridge

Performance and Observations

Construction of the Beaver River Temporary Bridge on Regional Road 15 restored the transportation connection between Downtown Beaverton and Highway 12 following the emergency closure of the existing bridge. The completed bridge is shown in Figure 14. The bridge has now been in service for almost two years with minimal maintenance requirements. During this period, Algonquin addressed localized deficiencies in the epoxy deck coating. The bridge remained open throughout the repairs, with traffic maintained under a single-lane, two-way operation. The repairs were completed on site in approximately four hours.

Figure 14. Completed Beaver River Temporary Bridge



Source: Region of Durham

Construction of the permanent replacement bridge began in Fall 2026, with the temporary bridge successfully incorporated into the staging design to avoid any further road closures during construction. The temporary bridge will remain in service until the first Stage of the permanent bridge construction is completed, which is anticipated to be in early 2027.

Conclusions and Lessons Learned

The Beaver River Temporary Bridge project demonstrates how a modular bridge solution can be used to rapidly restore a critical transportation connection following an unexpected bridge closure while supporting long-term infrastructure renewal objectives. Through collaboration between the Region of Durham, the Ministry of Transportation, Algonquin Bridge, regulatory agencies, and the Contractor, a two-lane CL-625-ONT rated crossing was successfully delivered within six months of project authorization despite significant site, environmental, utility and scheduling constraints. The temporary bridge has now been in service for close to two years and has continued to provide a reliable crossing while construction of the permanent replacement bridge proceeds.

A key lesson from this project is the value of early collaboration and integrated project delivery when responding to infrastructure emergencies. The accelerated schedule required bridge design, permitting, utility coordination, procurement and construction planning to proceed concurrently rather than sequentially. Close coordination between the Region, Algonquin Bridge, the Contractor, MTO, utility companies, and regulatory agencies enabled challenges to be identified and resolved early, allowing the

project team to adapt to site constraints, permitting requirements, material availability, and staging considerations. This collaborative approach supported efficient decision-making and was instrumental in achieving the accelerated project schedule.

The project also demonstrated the value of considering temporary and permanent works as a single integrated solution. Rather than functioning solely as an interim crossing, the temporary bridge alignment and foundation layout were developed to accommodate the staged construction of the permanent replacement bridge while maintaining traffic. Advancing preliminary road and bridge design for the permanent structure in parallel with the temporary bridge design minimized the potential for rework and ensured compatibility between the temporary and permanent works.

The modular panel bridge system proved particularly effective for the project requirements. Immediate availability of materials, rapid installation, elimination of in-water supports, and compatibility with future removal and construction staging made the system well suited to the site constraints. The project demonstrated that modern Bailey-style modular panel bridge systems can provide a practical, durable, and cost-effective solution for maintaining traffic during bridge replacement projects, particularly where accelerated implementation is required.

Overall, the Beaver River Temporary Bridge illustrates how collaborative planning, early stakeholder engagement, construction-driven design, and modular bridge technology can be combined to address unexpected infrastructure closures. The lessons learned from this project may provide valuable insight for municipalities and transportation agencies facing similar challenges associated with restoring transportation connectivity while advancing long-term infrastructure renewal objectives.

References

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